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PART 1

ORCHESTOIDEA GRACILIS, A NEW BEACH HOPPER
(AMPHIPODA: TALITRIDAE) FROM LOWER CALIFORNIA,
MEXICO, WITH REMARKS ON ITS LUMINESCENCE

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During a recent research cruise "La Blota" of the Inter-American Tropical Tuna Commission in Mexican coastal waters, Mr. James Joseph, Mr. Enrique Díaz, and the junior author made a small night collection of beach hoppers on a sandy beach at Cabo San Lucas, Baja California ($22^{\circ} 53' N$, $109^{\circ} 53' W$). The animals were easily located through their luminescence as they hopped about on the wet sand near the water's edge. They were collected individually with the aid of a flashlight. Upon close examination the amphipods were found to be distinct from any of the eight species of beach hoppers previously known from the Pacific coast of North and Central America (Bousfield 1957, 1960) and from other species of the genus *Orchestoidea* and are herewith described as *Orchestoidea gracilis* n. sp.

The present species is closely related to *Orchestoidea meridionalis* Schuster from El Salvador and *O. biolleyi* Stebbing from the Pacific coast of Costa Rica. The three species may constitute a natural subgroup within the genus *Orchestoidea* as presently defined. This tropical and warm-temperate subgroup differs from the cool-temperate typical forms (e.g. *O. tuberculata*, *O. pugettensis*, *O. californiana*) in having relatively long and slender body and limbs, shallow head, pronounced inferior antennal sinus, large maxilliped palp, complex and specialized pereopod dactyls (especially in pereopod 3), elon-

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gate peraeopod 5. slender pleopods. non-telescoping urosome. well-developed prepeduncle in uropod 1. elongate uropod 3. and spade-shaped bilobed telson. Moreover, the group exhibits unusual features of sexual dimorphism. not only in the expected differences between antennae 2. gnathopods. and peraeopods. but also in the differential development of the rami of uropods 2 and 3. Most of these features are shared also by "*Talorchestia*" *brito* Stebbing from western Europe and by *Orchestoidea brasiliensis* Dana from the Atlantic coast of South America. a fact indicating that presently accepted generic criteria have outlived their usefulness. However. formal recognition of these relationships must await a revision of the entire beach-hopper complex within the terrestrial amphipod family Talitridae.

KEY TO TROPICAL AMERICAN-PACIFIC SPECIES OF *Orchestoidea*

1. Dactyl of peraeopods 4 and 5 with 4-5 stiff bristles along inner margin; pleopods very weak. rami with only 3-5 plumose segments; uropod 3 of mature male longer than uropod 1
Orchestoidea meridionalis Schuster
 Dactyl of peraeopods 4 and 5 with single marginal bristle; pleopod rami with 7-14 plumose segments; uropod 3 of male short 2
2. Outer ramus of uropod 1 smooth. inner ramus with terminal spine about half its length; pleopod rami with 7-8 plumose segments; uropod 2 of mature male. inner ramus much longer than outer
Orchestoidea biolleyi Stebbing
 Outer ramus of uropod 1 armed with small outer marginal spines. inner ramus with terminal spine about one-quarter its length; pleopod rami with 11-15 plumose segments; uropod 2 of mature male. rami subequal
Orchestoidea gracilis n. sp.

ABBREVIATIONS FOR FIGS.

A1	Antenna 1	Mxpd	Maxilliped
A2	Antenna 2	Gn1	Gnathopod 1
Hd	Head	Gn2	Gnathopod 2
UL	Upper lip	P1-5	Peraeopods 1-5
LL	Lower lip	Ep1-3	Abdominal side plates 1-3
Rt. Md.	Right Mandible	Pl1-3	Pleopods 1-3
Lft. Md.	Left Mandible	U1-3	Uropods 1-3
Mx1	Maxilla 1	T	Telson
Mx2	Maxilla 2		

Family TALITRIDAE Bulycheva 1957

Genus *Orchestoidea* Nicolet 1849***Orchestoidea gracilis*, new species**

Description: Male (17.5 mm.). Head about as deep as long, convex above; inferior antennal sinus well incised. Eye very large, black, sub-trapezoidal, more than half length of head. Antenna 1 short, peduncular segments subequal, flagellum of 6-7 short segments. Antenna 2 very long, about equal to body length; flagellum much longer

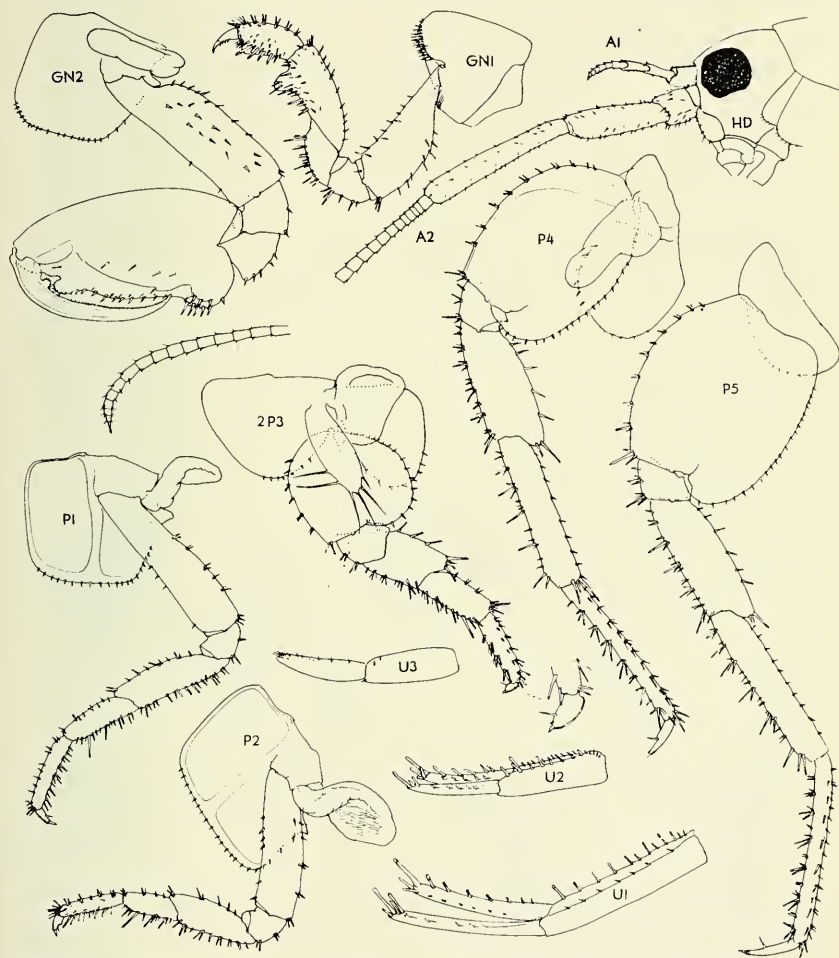


Figure 1. *Orchestoidea gracilis* new species from Cabo San Lucas, Baja California, Mexico. 1. Male, 17.5 mm, 2. Female, 14.5 mm.

than peduncle. of about 45 short untoothed segments, peduncular segments strong but not powerfully expanded. surfaces spinulose.

Upper lip slightly wider than deep. apically pilose. Lower lip with prominent lateral lobes. densely pilose along inner margin. Mandible. cutting edge with 4-6 teeth; left lacinia is 4-cusped. right lacinia is bifid; molar process finely striate (about 30 striations). Maxilla 1. apical spine-teeth of outer lobe relatively long and slender. all pectinate. a row of fine bristles at base of inner spine teeth; palp minute. appearing

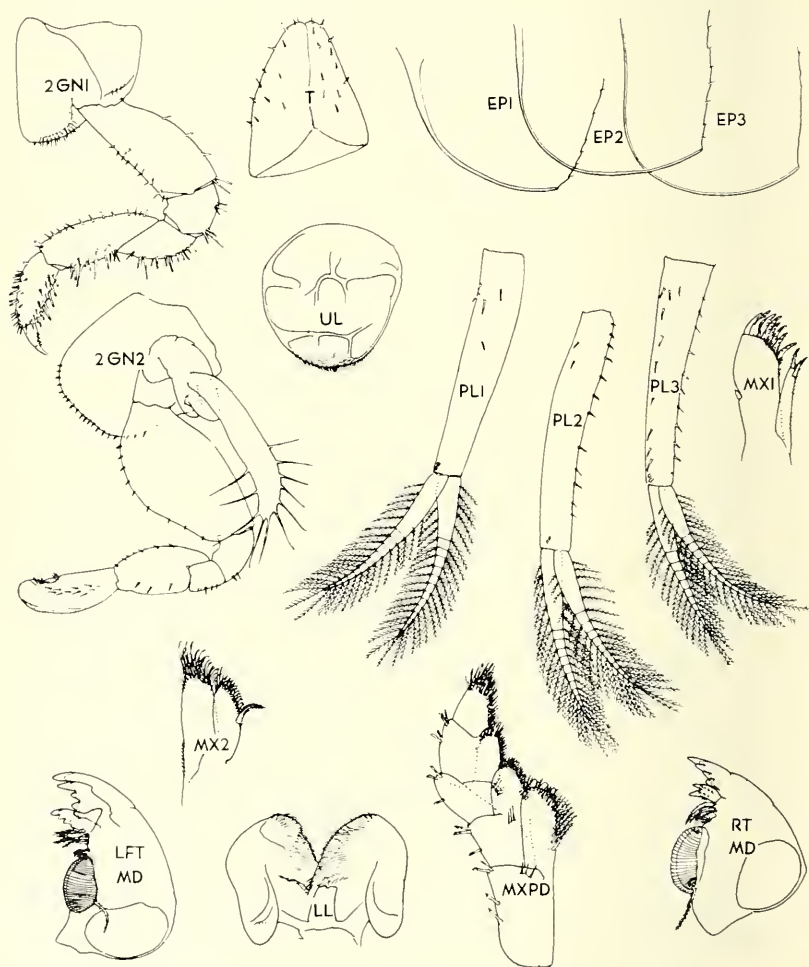


Figure 2. *Orchestoidea gracilis* new species from Cabo San Lucas, Baja California, Mexico. 1. Male, 17.5 mm. 2. Female. 14.5 mm.

one-segmented; inner plate with rather short plumose apical setae. Maxilla 2, inner lobe with strong proximal plumose seta; outer lobe larger, apically rounded. Maxilliped, inner lobe apically sub-truncate, with 3 subequal conical spine-teeth and about 8 marginal plumose setae; outer lobe apically rounded, extending well beyond inner lobe, outer apical setae are plumose, inner setae are minutely pectinate; palp very large, 3-segmented, outer marginal spines with compound tips.

Coxal plates 2-4 successively broader, each with distinct posterior lobe or knob. Coxa 5 much longer than deep, anterior lobe a little larger than posterior lobe. Gnathopod 1, coxal shelf prominent, forming a complete inner lower margin armed with long stiff spines; segment 5 with large and prominent pellucid process below; segment 6 rather broad, lower margin distally tumid and armed with heavy compound spines; dactyl strong, inner margin pectinate. Gnathopod 2 very large and robust; propod (segment 6) sub-ovate, spinose palm very oblique, slightly convex, with spinulose knob near base of dactyl, posterior angle defined by twin prominences each armed with 4-5 stout spines; dactyl strong, inner margin lined with minute spinules and a spinulose knob near hinge.

Peraeopods generally slender, anterior and posterior margins well armed with compound spines. Dactyls are relatively short, nails very small, outer margin convex, well chitinized, and minutely pilose distally, inner margin with single stiff bristle. Dactyl of peraeopod 2 with prominent spur on inner margin. Dactyl of peraeopod 3 very short, inflated and strongly convex behind, nail vestigial. Anterior marginal spines of segment 5 of peraeopod 3 not exceptionally long and strong. Peraeopod 5 distinctly longer than peraeopod 4, especially in segment 6. Coxal gills small, sac-like, somewhat elongate on peraeopod 4 and gnathopod 2.

Pleosome side plates 1-3 smoothly rounded below, posterior margins lined with 4-6 minute spinules. Pleopods 1 and 3 subequal, 2 largest; peduncles slender throughout, not laterally expanded, outer margin of 2 and both margins of 3 sparsely spinose; two small coupling spines; rami subequal, shorter than peduncles, each with 11-15 plumose segments.

Urosome segment 2 distinct, not telescoping dorsally with segment 1. Uropod 1 with strong prepoduncle; rami slender, subequal, nearly equal to peduncle, outer ramus with outer marginal spines only, terminal spines not spade-tipped nor exceptionally long. Uropod 2, rami and peduncle subequal, inner ramus with both margins spinose, outer

ramus with inner margin bare. Uropod 3 somewhat elongate, ramus slightly longer than peduncle, not laterally compressed, posterior margin minutely spinose. apex with tuft of short slender spines. Telson spade-shaped, longer than wide, dorsally and apically spinose, consisting of two medially fused lobes.

Female (14.5 mm.). Generally smaller and more compact than male. Antenna 1 much shorter. flagellum of 29-30 segments, slightly longer than peduncle.

Gnathopod 1 strong, blister lacking on lower margin of segments 5 and 6. Gnathopod 2, segment 2 moderately expanded in front, anterior margin sparingly spinose, distally sinuous or indented; segment 4 with short posterior lobe; segment 5 rounded beneath. upper margin minutely spinose; segment 6, "mitten" lobe extending well beyond dactyl. minute lateral spines rather sparse. Brood plates on segments 2-4 rather slender throughout, somewhat linear, with about 12 simple marginal setae; that of segment 5 shorter but broader, with fewer apical setae.

Uropod 2, rami subequal. Uropod 3, ramus and peduncle subequal. Telson short, slightly longer than wide.

Material Examined: Cabo San Lucas, Territorio Sur de Baja California, Mexico, on wet sand at water's edge. LW level, May 31, 1962. W. L. Klawe, J. Joseph, and E. Diaz coll.

Male (HOLOTYPE), Female (ALLOTYPE). NMC No. 6634; 7 female, 1 imm. male PARATYPES. NMC No. 6635.

HABITAT

The beach hoppers were collected on the Cabo San Lucas beach between one-half and one mile east of the Cabo San Lucas Pier. The animals were hopping on the wet, medium-to-coarse, arkosic sand.

LUMINESCENCE

Some individuals of *Orchestoidea gracilis* were luminescent, which aided in their location and capture. The entire body of the animals appeared to emit light.

There are several reports on luminous gammarids (*sensu lato*). According to Harvey (1952) the oldest is perhaps that by Thulis and Bernard, published in 1786, of a fresh water species from southern France. The earliest report on luminous marine gammarids is most likely that of Viviani (1805). Tilesius (1819) presents a figure of a

luminous marine amphipod and Van Vollenhoven (1860) reports on luminous *Orchestia littorea*.

Giard (1889, 1890) and Giard and Billet (1889) are to be credited with demonstrating the bacterial origin of luminescence in beach fleas. They inoculated non-luminous individuals of *Talitrus*, *Orchestia littorea*, *Hyale nilssoni*, and even some other crustacea, with light-producing bacteria from *Talitrus*. According to the above authors, the infection leads ultimately to death.

In 1927 Inman reported the bacteria-induced luminescence of *Talorchestia longicornis* and *Orchestia platensis*. He examined about 20,000 individuals, mostly of *T. longicornis*. The contents of the digestive tracts of some of the non-luminous individuals revealed the presence of a bacterium, causing the luminescence, which he referred to as *Bacterium giardi*. Although present in small numbers, it was an ubiquitous component of the intestinal flora of the animals he investigated. He postulated that under certain conditions these bacteria invade the muscles of the animal and increase in number so rapidly that the animal becomes luminous and finally dies. He pointed out the possibility that the bacteria may sometimes cause the death of a beach hopper without its becoming luminous.

Similarly, in the case of *Orchestoidea gracilis* collected in the area of Cabo San Lucas, we are dealing not with a self-induced luminescence but with one caused by luminous bacteria. Three facts lead to this conclusion: (1) The origin of light was not restricted to any particular part of the body, but the entire animal was glowing, (2) there is no morphological evidence that the animal possesses special light-producing organs, and (3) not all of the hoppers observed and collected were luminous.

Of pertinent interest is our observation that, at the water's edge where *O. gracilis* was collected, wave-cast fish bones emitted a faint glow. As beach hoppers in general are scavengers, the animals possibly become infected through ingestion of foodstuff on which the luminous bacteria are growing.

For a more detailed discussion, and also for a summary of reports and investigations on luminescence of amphipods caused by bacteria, we refer the reader to the classical treatise on bioluminescence by Harvey (1952).

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